

## Makrolon® sheet products and applications guide

# About this guide

**Designed as a quick reference tool**, this guide summarizes the main features, differences, and applications for Makrolon® sheet products.

**Organized by industries**, it shows typical applications for each product. Products with broader uses are listed in several industry categories.

**For complete information** on properties, warranty and agency compliance, visit [www.sheffieldplastics.com](http://www.sheffieldplastics.com)

## Information under column headings

**Major Industries** lists the markets generally served by a group of sheet products.

**Makrolon Grade and Description** lists formal product designations for ordering and referencing, and provides basic product descriptions.

**Key Product Features** describes each product’s key attributes and helps differentiate products from each other.

**Enhanced Performance Technology** covers three important areas:

- **Flame Inhibiting Performance:** A “V” indicates a special flame inhibiting grade of a standard product. Inherently flame inhibiting standard products are listed without the “V.” Flammability ratings shown relate to each industry.
- **Premium Optical Quality** defines products manufactured using our Targeted Optical Performance technology to meet optical quality levels important for the applications. Page 3 has more details on this technology.
- **Enhanced Surface Protection** describes different surface technologies that deliver UV and abrasion resistant benefits.

**Typical Applications** describes the most common uses for each product in the industry.

## Contents

	Page
Targeted Optical Performance Technology	3
Laminating Grades	3
<b>Products by Industry</b>	
Architectural & Construction	4, 5
Signage	4, 5
Lighting	4, 5
General Forming & Fabrication	6, 7
Transportation	6, 7
Safety Eyewear	6, 7



Process monitoring targets and maintains quality levels for optically enhanced grades

# Targeted Optical Performance Technology

Innovative process technology allows Bayer MaterialScience to target optical characteristics of Makrolon® sheet products to specific application requirements.

**The result:** higher quality products and greater production yields for our customers.

## Specified Quality (SQ) custom products:

Makrolon targeted optical performance technology allows customers to specify distortion and inclusion quality levels for unique optically critical applications. These customer-specific products are designed as SQ grades.

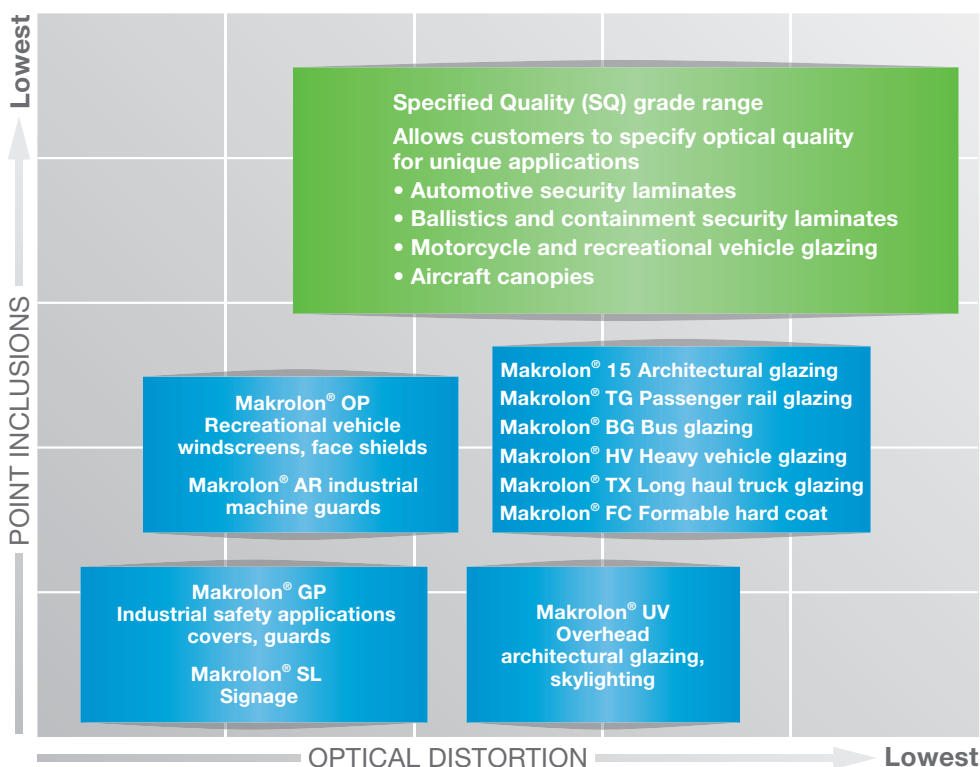
Bayer also develops new SQ grades for its own marketing initiatives. Once proven, they may become commercially available as specialty products.

## Standard products:

Standard Makrolon sheet products have targeted optical performance limits for inclusions and distortion based on well-established application requirements. Examples are coded in blue in this chart, and defined in detail in the product charts on the following pages.

## Optically improved laminating grades:

Specialty grades of Makrolon sheet have been developed with the enhanced optical qualities needed for use in multi-layered glazing laminates. Their minimal inclusion and haze levels are extremely important as the buildup of multiple layers increases apparent optical defects.



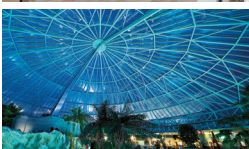






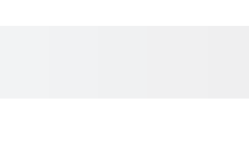




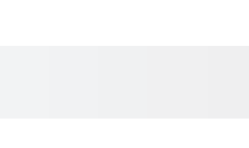



Grade Designation	Characteristics	Relative Optical Quality
AL	Automotive Laminate Critical optics for windows in security and armored vehicles	↑
AU	Ultra Clear Abrasion Resistant One side abrasion / UV resistant coated for architectural quality security glazing	
UC	Ultra Clear Uncoated Uncoated sheet for multi-layer architectural quality security glazing	
OP	Optically Improved vs GP grade Commercial security glazing	

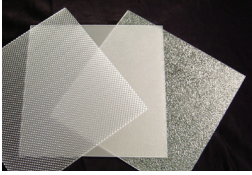


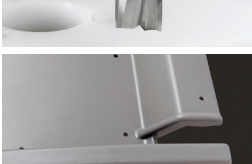







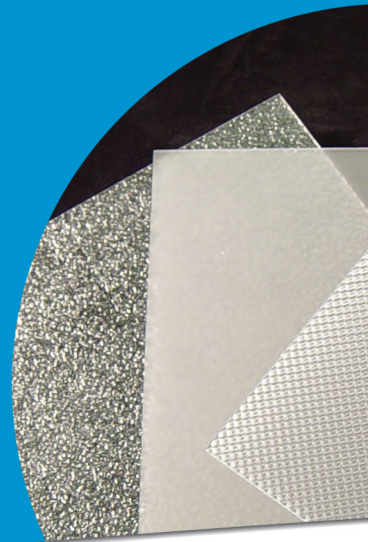
# Makrolon® polycarbonate sheet products

...Technology adapted to the performance and aesthetic demands of specific industries

Major Industries	Makrolon Grade and Description		Key Product Features	ENHANCED PERFORMANCE TECHNOLOGY				Typical Applications
				Enhanced Flame Inhibiting Performance		Premium Optical Quality	Enhanced Surface Protection	
				Grades	Ratings	Produced to Application Specs	Proprietary Technology	
<b>ARCHITECTURAL</b>								
	15	15 year UV, abrasion resistance	15 year warranty: abrasion and UV resistant coating			•	Abrasion and UV protection	Architectural glazing for commercial, municipal, medical, residential, retail and other buildings; transportation centers
	AR	Abrasion Resistant	7 year warranty: abrasion and UV resistant coating	AR-V	UL 94 HB ≥ 0.118" UL94, V-1 ≥ 0.236" V-0 ≥ 0.358"	•		Replacement glazing, industrial guarding, safety components
	UV	UV Resistant	UV resistance, can be cold formed on site	UV-V	UL 94 V-2 ≥ 0.060" UL 94 V-0 ≥ 0.220"	•	UV protection	Awnings, entryway canopies, skylights, barrel vaults, glazed archways, covered pedestrian walkways and sloped, vertical and curved glazing
	multi UV	Multi Wall UV resistant	Light weight, high structural strength, multiple geometries for different structural and insulating properties					Greenhouses, solariums and atriums, covered walkways, insulative privacy glazing
	GP Matte GP Pebble	General Purpose Patterned	Textured surface, translucent, reduces glare, hides scratches	GP-V Matte GP-V Pebble	UL 94 V-2 ≥ 0.060" UL 94 V-0 ≥ 0.220"			Industrial, privacy, decorative glazing, awnings, skylights, shower doors, lighting covers
<b>HYGARD® Security Sheet and Laminates</b>								
	CG375	Containment Glazing, 0.375" thick	Meets ASTM F 1915, HP White TP 0500			•	Abrasion and UV protection	Detention and psychiatric containment glazing
	CG500	Containment Glazing, 0.500" thick	Meets ASTM F 1233 Class II, HP White TP 0500, Level A Ballistics			•		
	CG750	Containment Glazing, 0.750" thick	Meets ASTM F 1233 Class III, HP White TP 0500, Level A Ballistics			•		
	BR750	Bullet Resistant, 0.750" thick	Meets UL 752 Level 1			•		Ballistic resistant glazing for government, institutional and commercial installations
	BR1000	Bullet Resistant, 1.00" thick	Meets UL 752 Level 2, HP White TP 055 Level IV			•		
	BR1250	Bullet Resistant, 1.250" thick	Meets UL 752 Level 3, HP White TP 0500 Level IV, ASTM F 1233 Class 5			•		
	MS1250	Multi-Shot bullet resistant, 1.250" thick	Meets UL 752 Level 6			•		
<b>SIGNAGE</b>								
	SL	Sun Life	Co-extruded UV resistant surface available 1 or 2 sides	SL-V	UL 94 V-2 ≥ 0.060" UL 94 V-0 ≥ 0.236"		UV protection	Flat and formed sign faces and channel letters
	SL Matte	Sun Life, Matte surface	Co-extruded UV resistant surface with matte texture					Flat and formed sign faces and channel letters using LED's
	LD	LED Grade	Specially formulated for LED light diffusion, co-extruded UV surface technology, standard industry colors					
	AR-1	Abrasion Resistant 1 side	Abrasion and UV resistant on 1 side and standard printable surface on the other side	AR-V	UL 94 HB ≥ 0.118" UL 94 V-1 ≥ 0.236"	•	Abrasion and UV protection 1 side	Single surface decorative applications
<b>LIGHTING</b>								
	Lumen XT	LED Light Diffusing Grade	Specifically formulated for superior LED and conventional light diffusion, wide range of diffusion levels	LC LW	UL 94 V-2 ≥ 0.060"			Interior LED and conventional lighting fixtures
	GP Prismatic	Prismatic lens grade	Light diffusing prismatic pattern					Lighting lenses and covers

more products...

Major Industries	Makrolon Grade and Description		Key Product Features		ENHANCED PERFORMANCE TECHNOLOGY			Typical Applications	
					Enhanced Flame Inhibiting Performance		Premium Optical Quality		Enhanced Surface Protection
					Grades	Ratings	Produced to Application Specs		Proprietary Technology
<b>GENERAL FORMING and FABRICATION</b>									
	GP	General Purpose Clear	Basic clear polycarbonate, impact resistant, for interior and short term exterior applications	GP-V	UL 94 V-2 ≥ 0.060" UL 94 V-0 ≥ 0.220"			Industrial glazing, machine guards, structural parts, thermoformed and fabricated components	
	GP Patterns	General Purpose Patterned	Pebble and matte surface finishes, 1 side					Industrial glazing, privacy glazing, signs, displays, lighting covers	
	OP	Optical Grade	Higher optical quality	OP-V	UL 94 V-2 ≥ 0.060" UL 94 V-0 ≥ 0.220"	•		Recreational vehicle windscreens, face shields, laminates	
	FI	Flame Inhibiting	UL 94 V-0 and 5V rated, not UV stabilized	FI	UL 94 V-0 ≥ 0.060" UL 94 5VA ≥ 0.125"			Electrical devices, equipment housings, switchgear covers, light fixtures	
	LF	Low Flammability	UL 94 V-0, has UV inhibitor	LF	UL 94 V-0 ≥ 0.080" FAR 25.853 (a), 1, (i)			Electrical devices, equipment housings, switchgear covers, light fixtures, aviation components	
	FD	Food Grade	FDA compliant for food contact					Process machinery guards, bulk food bins, candy molds, sneeze guards, limited use autoclave packaging, hospital trays, bassinets, incubators, medical device storage containers	
	FC	Formable Hard Coat	Cold formable and drape formable, meets ANSI Z26.1 AS-6			•	Abrasion and UV protection	Formed industrial applications, face shields, recreational vehicle windscreens	
	AR	Abrasion Resistant	Abrasion and UV resistant coating, 1 or 2 sides			•		Glazing replacement, machine guards & laminates	
	MG	Machine Grade	0.750" - 2.0" thick for machining, textured surface	MG, WG	UL 94 V-0 ≥ 0.395"			Manifold, insulators, diaphragms, electrical, semiconductor, military applications	
	WG	Window Grade	0.750" - 2.0" thick, optical quality			•		Sight windows for tanks/vessels, viewports, medical parts, military applications	
<b>TRANSPORTATION</b>									
	Bayblend® MTR	Mass Transit Interiors	Opaque sheet for mass transit interiors. Meets Federal Railway Agency / DOT standards for flame and smoke, and toxic gas generation	MTR, MTR-AG	FRA 49 CFR 238, Bombardier SMP 800-C		Anti-graffiti (AG grade)	Thermoformed rail interior parts such as structural seating components, wall cladding, window reveals, ceiling panels	
	TG	Transportation Glazing	Optical performance for rail car glazing, meets Federal Railway Agency standards for flammability, ballistics, and impact	TG	FRA 49 CFR 238, App B, ANSI Z26.1 AS-4	•	Abrasion and UV protection	Passenger rail car glazing, automotive glazing	
	BG	Bus Glazing	Optical performance for bus glazing, meets ANSI Z26.1 AS-4 and FMVSS 302			•		Bus window glazing	
	TX	Truck Glazing	UV and abrasion life for truck cab glazing, meets ANSI Z26.1 AS-4			•		Commercial truck side windows	
	HV	Heavy Vehicle Glazing	Low distortion for heavy off-road vehicles, meets ANSI Z26.1 AS-4			•		Construction, logging, agricultural and industrial vehicle glazing	
	FC	Formable Hard Coat	Cold formable and drape formable, meets ANSI Z26.1 AS-6			•		Motorcycle and recreational vehicle windscreens	
	OP	Optical Grade	Higher optical quality			•		Motorcycle and recreational vehicle windscreens	
	UC	Ultra Clear	High light transmission and high optical quality			•		Military aircraft canopies	
	FI	Flame Inhibiting	FAR compliant @ 0.060" & 0.125", non UV stabilized	FI	FAR 25.853 60-s Vertical Burn			Aviation components	
	LF	Low Flammability	FAR compliant @ 0.080" - 0.236", UV stabilized	LF	FAR 25.853 60-s Vertical Burn			Aviation components	
<b>SAFETY EYEWEAR</b>									
	OP	Optical Grade	Improved optical quality, meets ANSI Z87.1			•		Protective goggles, lenses, and shields	
	IR	IR and UV Blocking	Meets welding shades 3 and 5, complies with ANSI Z87.1, EN 169: CSA Z94.3			•	IR blocking	Face shields for flame welding and cutting, general IR protection	
	FC	Formable Hard Coat	Cold curve and drape formable, meets ANSI Z87.1			•	Abrasion and UV protection	Formed face shields	



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Bayer MaterialScience LLC has a long-standing commitment to sustainability and the environment, and its products have been used for decades to advance sustainability in building and construction. Solutions from Bayer MaterialScience LLC for the construction industry help conserve energy through such products as customized polyurethane spray foam and polyiso board insulation, polycarbonate sheeting for day lighting and LED lighting applications. Additionally, pMDI particle board and medium-density fiberboard, as well as waterborne, renewable content and ultra low-to-zero volatile organic compound (VOC) sealants and high-performance coatings help improve indoor air quality and also extend service life and reduce overall maintenance costs.